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Applicant: Yoshiaki SHIOTA

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UTILITY PATENT APPLICATION TRANSMITTAL

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

Transmitted herewith for filing under 37 C.F.R. § 1.53(b) is the nonprovisional utility patent application of:

Yoshiaki SHIOTA

Enclosed are:

[X] Specification, Claim(s), and Abstract (14 pages).

[X] Formal drawings (2 sheets, Figures 1-2).

[X] Declaration and Power of Attorney (2 pages).

[X] Assignment of the invention to NEC CORPORATION.

[X] Assignment Recordation Cover Sheet.

[X] Claim for Convention Priority and Priority Document.

[X] Information Disclosure Statement.

[X] Form PTO-1449 with copies of 5 listed reference(s).

The filing fee is calculated below:

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Basic Fee							$690.00		$690.00
Total Claims:	8	-	20	=	0	x	$18.00	=	$0.00
Independents:	1	-	3	=	0	x	$78.00	=	$0.00
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[**X**] A check in the amount of $730.00 to cover the filing fee is enclosed.

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Please direct all correspondence to the undersigned attorney or agent at the address indicated below.

Respectfully submitted,

June 7, 2000
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FAULT MANAGEMENT SYSTEM FOR SWITCHING EQUIPMENT

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to fault management of a circuit section of a switching equipment such as an exchange or a router which includes a processor such as a frame relay, and more particularly to a management system for an recoverable and critical fault.

Description of the Related Art

A switching equipment such as an exchange or a router includes a processor which performs central control, a switch section, and a circuit processing section (refer to, for example, Japanese Patent Laid-Open No. Hei 08-256178 or No. Hei 06-350695). The circuit processing section sometimes includes a local processor for performing protocol processing or routing processing for input/output packets or load distribution (refer to, for example, Japanese Patent Laid-Open No. Hei 09-289524). Generally, a communication protocol is formed in a hierarchical model including a physical layer which is the lowermost layer, a data link layer and other higher layers, and the layers are definitely separate from each other. The processor takes charge of processing of packets and data in the data link layer or higher layers.

Conventionally, if an unrecoverable and critical fault about the processor occurs with the circuit processing section

of an equipment of the type described above, then it is necessary for an operator to manually input a compulsory reset instruction to the circuit processing section from a console to compulsorily cut a circuit in order to prevent a disabled condition of data transmission/reception or a condition wherein disconnection of a circuit for preventing such a disabled condition of data transmission/reception is impossible as disclosed in Japanese Patent Laid-Open No. Hei 06-075876.

FIG. 1 shows a fault circuit compulsory resetting system disclosed in Japanese Patent Laid-Open No. Hei 06-075876. Referring to FIG. 1, if an operator command for changing a state of a communication circuit 104 is inputted from a console 105 by an operator, then a command analysis section 116 of a host computer 101 analyzes the operator command. If the operator command is a communication circuit connection command, then the command analysis section 116 sends a connection request to a circuit state changing section 115. However, if the analyzed operator command is a communication circuit disconnection command, then the command analysis section 116 sends a disconnection request to the circuit state changing section 115. On the other hand, if the analyzed operator command is a command for compulsorily resetting a communication circuit, then the command analysis section 116 sends a compulsory reset request to a compulsory circuit disconnection section 117.

If the circuit state changing section 115 receives a circuit connection request from the command analysis section 116, then it performs connection of the circuit through a circuit control section 113 and sets a circuit state of a circuit state management table 111 to "connected". On the other hand, if the circuit state changing section 115 receives a disconnection request of a circuit from the command analysis section 116, then it performs disconnection of the circuit through the circuit control section 113 and sets the circuit state of the circuit state management table 111 to "disconnected". Further, if the circuit state changing section 115 receives a fault notification of a circuit from the circuit control section 113, then it sends a fault notification of the circuit to a data transfer section 114 and sets the circuit state of the circuit state management table 111 to "fault".

If the data transfer section 114 receives a data transmission/reception request from an on-line information processing program section 112, then it searches the circuit state management table 111 for a pertaining communication circuit using a circuit identification name as a key and discriminates whether or not the circuit state of the communication circuit is "connected". If the circuit state is "connected", then the data transfer section 114 performs communication of data with a terminal equipment 102 and an external host computer 103 through the circuit control section

113. However, if the circuit state is not "connected", then the data transfer section 114 sends a transmission/reception failure notification.

On the other hand, if the data transfer section 114 receives a fault notification from the circuit state changing section 115 or the compulsory circuit disconnection section 117, it stops the data communication and notifies the on-line information processing program section 112 that transmission/reception of data is abnormal.

If the compulsory circuit disconnection section 117 receives a compulsory resetting request of a circuit from the command analysis section 116, then it sends a fault notification to the data transfer section 114 and sets the circuit state of the circuit state management table 111 to "fault".

However, the fault management system described above is disadvantageous in that, since it is necessary for its operator to enter a compulsory reset command by a manual inputting operation into the console, considerable time is required until a fault is removed after the fault occurs. Consequently, it is a matter of course that communication processing cannot be performed before the fault is recovered. Besides, if the fault occurs about the processor which performs data transmission/reception processing, then there is the possibility that the circuit section may malfunction and signal illegal data, which should not originally be transmitted, to

a terminal equipment or the like (associated apparatus) on the opposing side to the circuit section, resulting in a malfunction of the associated apparatus. Even if the circuit section does not malfunction, it likely occurs that the processor stops and processing on the data link layer or on a higher layer stops while the physical layer operates normally, and it is difficult for the associated apparatus to discriminate the fault.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a fault management system for a switching equipment by which, when an recoverable fault occurs with a processor or a circuit section of the switching equipment, a malfunction of an associated terminal equipment or the like or a fault of a physical layer in an associated apparatus can be detected without depending upon a manual operation of an operator.

In order to attain the object described above, according to the present invention, there is provided a fault management system for a switching equipment which includes a circuit section and a processor for performing setting and control of the circuit section and transmits and receives data to and from a terminal equipment or the like, comprising a fault detection section for detecting a fault which occurs in the switching equipment, and a concentrated fault management section operable when the fault detection section detects an

unrecoverable fault for continuously signaling a reset signal for resetting the processor and the circuit section to the processor and the circuit section.

In the fault management system for a switching equipment, also the circuit section is reset, and consequently, a circuit is disconnected. Consequently, the switching equipment does not signal illegal data to a terminal equipment associated with the circuit section or a switch in the switching equipment, and besides, detection of a fault of the physical layer can be performed definitely by the associated apparatus.

Preferably, the fault detection section detects whether or not supply of a clock signal of an oscillator which supplies the clock signal to the processor is interrupted, and notifies, when the supply of the clock signal is interrupted, the concentrated fault management section of the result of the detection as an unrecoverable fault.

The concentrated fault management section may be connected to and supervise a processor bus which interconnects the processor and the circuit section and continuously signal, when a fault occurs with the processor bus, a reset signal to the processor and the circuit section.

The concentrated fault management section may send a notification of occurrence of a fault to a central control section connected to an external console.

The fault management system for a switching equipment is advantageous in that, when a critical fault occurs about

the processor, it is not necessary for an operator to perform disconnection of a circuit by manually inputting a reset command or the like. The reason is that the concentrated fault processing section automatically signals a reset signal to disconnect the circuit.

The fault management system for a switching equipment is advantageous also in that the possibility that, when an unrecoverable fault occurs around the processor which performs setting and control of the circuit section, illegal data which should not naturally be transmitted at all from the circuit section to a terminal equipment or the like associated with the circuit section may be signaled to and cause a malfunction of the associated apparatus is eliminated. Further, where the processor performs processing such as working for all of packets and data which pass the circuit section, even if a fault occurs such that only data in the data link layer or an upper layer does not flow while no fault occurs with the physical layer of the circuit, disconnection of the circuit can be recognized by the associated terminal equipment or the like. The reason is that, when a fault occurs, the concentrated fault management apparatus automatically signals a reset signal immediately.

The above and other objects, features and advantages of the present invention will become apparent from the following description and the appended claims, taken in conjunction with the accompanying drawings in which like parts or elements are

denoted by like reference symbols.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram showing a construction of a conventional fault management system; and

FIG. 2 is a block diagram showing a construction of a fault management system to which the present invention is applied.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 2, there is shown a fault management system to which the present invention is applied.

A data switching exchange 1 includes a processor 2, a quartz oscillator 3 for supplying a clock signal to the processor 2, a clock fault detection section 4 for detecting whether or not supply of the clock signal is interrupted, a circuit section 7 connected to an external terminal equipment 10 or the like over a communication circuit, a concentrated fault management section 9 for continuously signaling a reset signal 5 and a reset signal 8 to the processor 2 and the circuit section 7, respectively, when an unrecoverable fault occurs, a switch section 11 for communicating data with the circuit section 7, and a central control section 12.

When the data switching exchange 1 operates normally, the processor 2 receives and operates with the clock signal from the quartz oscillator 3 and performs setting and control

of the circuit section 7, protocol processing of a transmission/reception packet and so forth over a processor bus 6.

The circuit section 7 receives data from the terminal equipment 10 or the like and transfers the data to the switch section 11 under the setting and control from the processor bus 6. Further, the circuit section 7 receives data from the switch section 11 and transfers the data to the terminal equipment 10 or the like. A packet or data for transmission/reception is data in a layer higher than the physical layer.

The clock fault detection section 4 is formed from a monostable multivibrator and receives the clock signal from the quartz oscillator 3 to supervise the normality of the clock signal. If the clock signal is interrupted, then the clock fault detection section 4 sends a fault notification to the concentrated fault management section 9.

The concentrated fault management section 9 is connected to the processor bus 6 to supervise the normality of the processor bus 6 and receives a fault notification from the clock fault detection section 4. If a fault occurs, then the concentrated fault management section 9 continuously transmits the reset signal 5 and the reset signal 8 to the processor 2 and the circuit section 7, respectively, and sends a fault notification to the central control section 12.

The central control section 12 is connected to an

external console 13 and sends a notification to the console 13 when a fault occurs. The operator can recognize occurrence of the fault through the console 13.

While a preferred embodiment of the present invention has been described using specific terms, such description is for illustrative purposes only, and it is to be understood that changes and variations may be made without departing from the spirit or scope of the following claims.

What Is Claimed Is:

1. A fault management system for a switching equipment which includes a circuit section and a processor for performing setting and control of said circuit section and transmits and receives data to and from a terminal equipment or the like, comprising:

a fault detection section for detecting a fault which occurs in said switching equipment; and

a concentrated fault management section operable when said fault detection section detects an unrecoverable fault for continuously signaling a reset signal for resetting said processor and said circuit section to said processor and said circuit section.

2. A fault management system for a switching equipment as claimed in claim 1, wherein said fault detection section detects whether or not supply of a clock signal of an oscillator which supplies the clock signal to said processor is interrupted, and notifies, when the supply of the clock signal is interrupted, said concentrated fault management section of the result of the detection as an unrecoverable fault.

3. A fault management system for a switching equipment as claimed in claim 1, wherein said concentrated fault management section is connected to and supervises a processor bus which interconnects said processor and said circuit section and continuously signals, when a fault occurs with said processor bus, a reset signal to said processor and said circuit

section.

4. A fault management system for a switching equipment as claimed in claim 2, wherein said concentrated fault management section is connected to and supervises a processor bus which interconnects said processor and said circuit section and continuously signals, when a fault occurs with said processor bus, a reset signal to said processor and said circuit section.

5. A fault management system for a switching equipment as claimed in claim 1, wherein said concentrated fault management section sends a notification of occurrence of a fault to a central control section connected to an external console.

6. A fault management system for a switching equipment as claimed in claim 2, wherein said concentrated fault management section sends a notification of occurrence of a fault to a central control section connected to an external console.

7. A fault management system for a switching equipment as claimed in claim 3, wherein said concentrated fault management section sends a notification of occurrence of a fault to a central control section connected to an external console.

8. A fault management system for a switching equipment as claimed in claim 4, wherein said concentrated fault management section sends a notification of occurrence of a

fault to a central control section connected to an external console.

ABSTRACT OF THE DISCLOSURE

A fault management system for a switching equipment is disclosed by which, when an recoverable fault occurs with a processor or a circuit section of a switching equipment, a malfunction of an associated terminal equipment or the like or a fault of a physical layer in an associated apparatus can be detected without depending upon a manual operation of an operator. When a clock fault detection section detects that supply of a clock signal of a quartz oscillator which supplies the clock signal to a processor is interrupted, it notifies a concentrated fault management section of the result of the detection as an unrecoverable fault. The concentrated fault management section receives the notification and continuously signals reset signals for resetting the processor and a circuit section to the processor and the circuit section, respectively. Further, the concentrated fault management section sends a fault notification to a central control section connected to an external console.

FIG.1

PRIOR ART

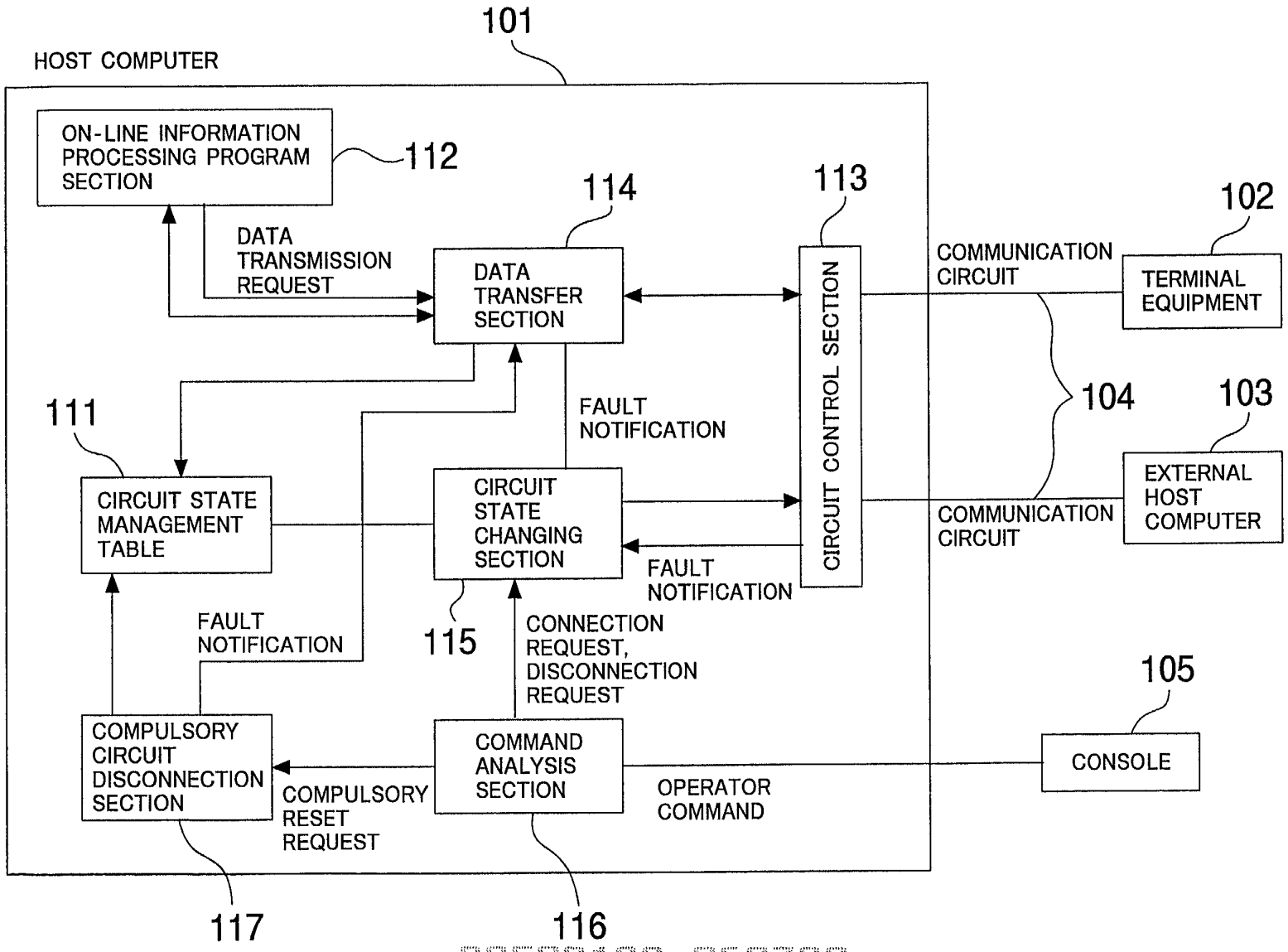
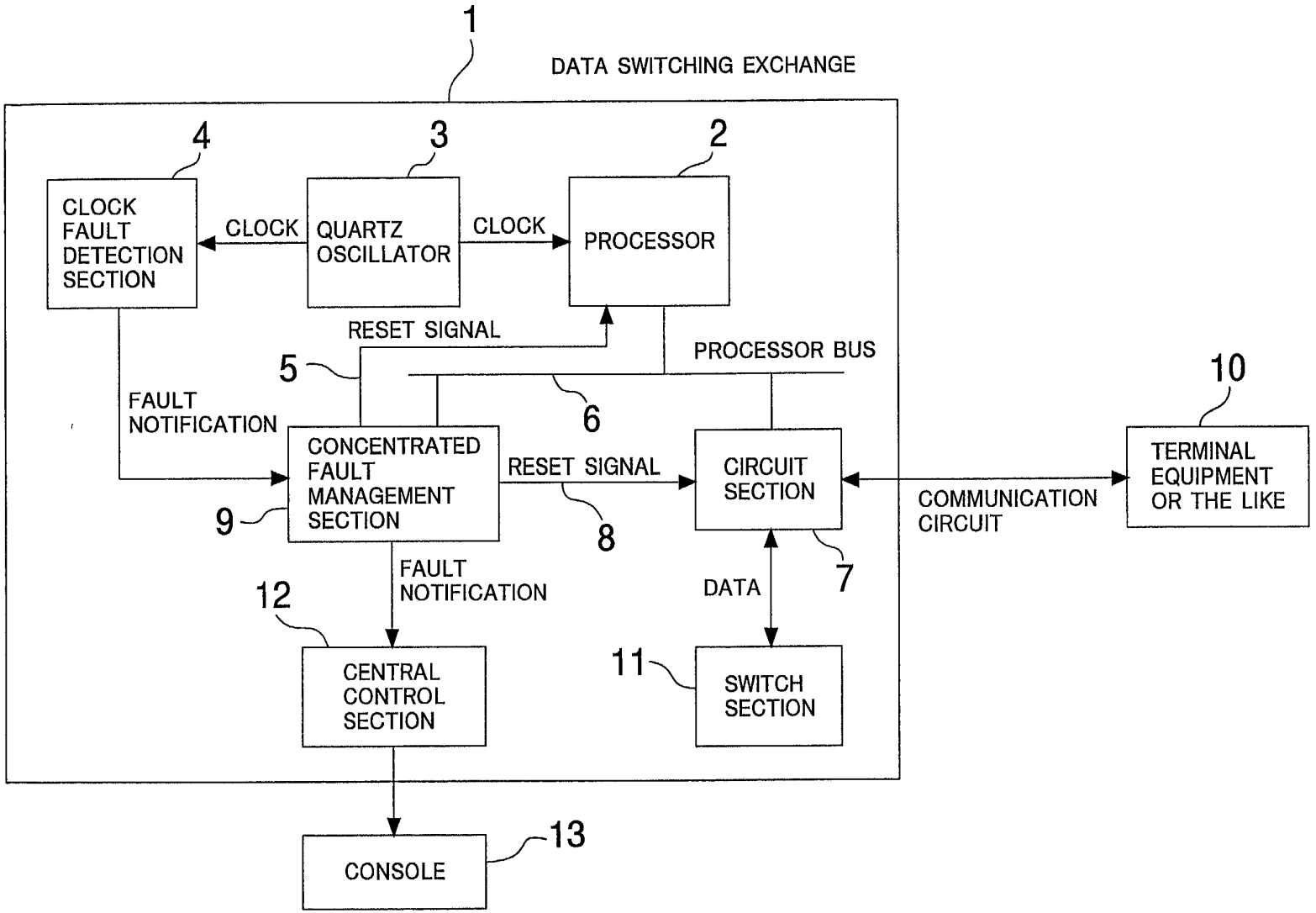


FIG.2



Docket No. _____

DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

FAULT MANAGEMENT SYSTEM FOR SWICHING EQUIPMENT

the specification of which is attached hereto unless the following box is checked:

☐ was filed on _____ as United States Application Number or PCT International Application Number _____ and was amended on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is known by me to be material to patentability as defined in Title 37, Code of Federal Regulations § 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, § 119(a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate, or § 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below any foreign application for patent or inventor's certificate, or PCT International application having a filing date before that of the application on which priority is claimed:

PRIOR FOREIGN APPLICATION(S)

NUMBER	COUNTRY	DAY/MONTH/YEAR FILED	PRIORITY CLAIMED
11-161416	Japan	08/06/1999	Yes

I hereby claim the benefit under Title 35, United States Code § 119(e) of any United States provisional application(s) listed below.

APPLICATION NO.	FILING DATE

I hereby claim the benefit under Title 35, United States Code, § 120 of any United States application(s), or § 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose information which is known by me to be material to patentability as defined in Title 37, Code of Federal Regulations § 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application:

APPLICATION SERIAL NO.	FILING DATE	STATUS: PATENTED, PENDING, ABANDONED

I hereby appoint as my attorneys, with full powers of substitution and revocation, to prosecute this application and transact all business in the Patent and Trademark Office connected therewith: Stephen A. Bent, Reg. No. 29,768; David A. Blumenthal, Reg. No. 26,257; John J. Feldhaus, Reg. No. 28,822; Donald D. Jeffery, Reg. No. 19,980; Eugene M. Lee, Reg. No. 32,039; Peter G. Mack, Reg. No. 26,001; Brian J. McNamara, Reg. No. 32,789; Sybil Meloy, Reg. No. 22,749; George E. Quillin, Reg. No. 32,792; Colin G. Sandercock, Reg. No. 31,298; Bernhard D. Saxe, Reg. No. 28,665; Charles F. Schill, Reg. No. 27,590; Richard L. Schwaab, Reg. No. 25,479; Arthur Schwartz, Reg. No. 22,115; Harold C. Wegner, Reg. No. 25,258.

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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Post Office Address		